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W. A. WITHERS, A. M., ACTING DIRECTOR.

VINEGAR ADULTERATION

AND THE EXTENT TO WHICH IT EXISTS IN THE SAMPLES FOR SALE IN NORTH CAROLINA.

W. A. WITHERS AND J. A. BIZZELL.

RALEIGH, N. C

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RALEIGH, N. C.

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VINEGAR ADULTERATION AND THE EXTENT TO WHICH IT EXISTS IN NORTH CAROLINA.

W. A. WITHERS, A. M., CHEMIST.
J. A. BIZZELL, B. S., ASSISTANT CHEMIST.

Commercial vinegar is essentially a dilute aqueous solution of acetic acid. It contains small quantities of alcohol, aldehyde, acetic e her and various extractive matters, which import a characteristic flavor and aroma.

The quantity of acetic acid in vinegar varies from 3 per cent. to 8 per cent., depending upon its source. This acid is produced by the fermentation of alcohol, the change usually being spoken of as *acetic fermentation* in distinction from *alcoholic fermentation* which it frequently follows. Acetic fermentation chemically is essentially oxidation. The transformation in some cases, is spon aneous, while in others artificial methods are necessary. Under the following conditions acetic fermentation sets in:* (1) a liquid weak in alcohol, containing not more than 12 per cent., (2) abundant access of air, (3) a temperature of from 20 ° to 30 ° C. (68 ° to 95 ° F.,) (4) acetic ferments. These ferments consist of peculiar microscopic plants, the most common of which is technically called *Mycoderma aceti.* When these germs fall from the air into suitable liquids they develop under certain conditions a gelatinous mass, which, on increasing in weight, settles to the bottom of the vessel and constitutes what is commonly called "Mother of vinegar."

VARIETIES OF VINEGAR.

The principal varieties are as follows:*

(1) wine vinegar made from grape juice and inferior wines; (2) spirit vinegar, from potato brandy in Germany and from whiskey in the United States; (3) malt vinegar, made from malt wort, similar to that prepared for grain spirit manufacture; (4) cider vinegar, from spontaneous fermentation of apple juice; (5) vinegars of limited use, manufactured from glucose, cane-sugar, sugar-beets and molasses.

The following table shows the composition of the most common varieties of vinegar manufactured and sold in the United States:

*Sadtler Hand-book Industrial Organic Chemistry

TABLE I*.

	ACETIC ACID.	TOTAL SOLIDS.	ASH.
Cider	4.46 per cent.	2 83 per cent.	.39 per cent.
Wine	4.54 per cent	2.77 per cent.	.30 per cent.
Malt	4 86 per cent.	2.16 per cent.	.24 per cent.
Spirit	3.84 per cent.	.38 per cent.	.06 per cent.

ADULTERATION AND FRAUD.

According to Blyth,† the adulterants of vinegar, which have been found and which are employed, to some extent, at present are (1) water, (2) mineral acids, (3) metals—arsenic, copper, lead and zinc, (4) pyroligneous or wood acid, (5) organic coloring matters. The above taken from an English work, represents fairly well the adulterants used to a large extent, in English vinegars. It is satisfactory to note, however, that in a large number of samples of vinegar examined in different parts of the United States deleterious adulterants have seldom been used. The fraud practiced in the United States consists: (1) an addition of water to increase the bulk—a very common method of adulteration as shown by the analyses of the samples examined; (2) in substituting one variety of vinegar in order to increase the sale. A very large portion of vinegar is made in the United States from spirituous liquors. Battershall‡ says, "It is probable that fully 90 per cent. of the total production is obtained by the acetic fermentation of whiskey." The vinegar thus produced is nearly colorless. It is colored, however, with caramel and other organic coloring matter and placed upon the market as apple vinegar. Cider vinegar producers, therefore, have found it impossible to compete with unscrupulous manufacturers, who impose on the public by selling "apple vinegar" made from low-wines.

COLLECTION OF SAMPLES.

The object of our work has been to determine to what extent adulterants are present in the vinegars sold in North Carolina, and to what extent fraud is practiced upon the people of the State. As many different samples as were obtainable were bought from dealers in Raleigh, Durham, Henderson, Statesville and Wilmington. No effort was made to select places in which it might be supposed that adulterated goods would be most abundant. To this end samples were obtained from "fancy groceries" as well as from the cheaper places.

*Jour. Am. Chem. Soc. 20. 6.
†Foods composition and Analyses.
‡Food Adulteration and its Detection.

METHODS OF ANALYSIS.

The methods employed in the examination were those proposed to the Association of Official Agriculturists at its fourteenth annual convention.

RESULTS OF ANALYSIS.

The following table gives the results of the analysis of twenty samples of vinegar:

TABLE II.

Laboratory No.	Analysis.			Name given by retailer.	Name of Manufacturer.
	Acetic Acid. Per cent.	Total Solids. Per cent.	Ash. Per cent.		
1042	4.41	637	.135	Cider vinegar	H. J. Hinz, Pittsburgh, Pa.
1084	4.65	.359	.052	"	Jos. S. Friedman, Paducah, Ky.
1085	4.41	.415	.083	"	Wallace Bros., Louisville, Ky.
1086	1.75	.570	.108	"	Alden Vinegar Company, Louisville, Ky.
1170	4.18	76	45	"	(Not given.)
1128	4.55	.355	.038	"	Jones Bros., Louisville, Ky.
1129	3.08	.250	.031	"	Jones Bros., Louisville, Ky.
1130	4.83	343	033	"	R. M. Hughes, Louisville, Ky.
1131	4.24	3.67	.319	"	J. C. and S. R. Mott.
1132	4.42	.262	.018	"	J. C. and S. R. Mott.
1133	4.98	.228	.018	Grape vinegar	H. J. Hinz, Pittsburgh, Pa.
1134	3.73	.800	.150	Cider vinegar	Gregory Bros., Richmond, Va.
1135	4.21	.336	.064	"	Gregory Bros., Richmond, Va.
1136	4.17	.461	.079	"	Price Lucas, Louisville, Ky.
1137	3.98	.404	.083	"	Louisville Cider Works, Louisville, Ky.
1196	4.38	65	.38		William Munson, Baltimore, Md.
1265	4.55	71	.087		(Not given.)
1259	1.57	.655	.021		Piedmont Cider and Vinegar Works, Lynchburg, Va.
1266	4.56	.34	.047		(Not given.)
1267	4.51	.34	.052		(Not given.)

CONCLUSIONS.

The above table represents the analyses of twenty samples of vinegar, fourteen of which were sold for pure cider vinegar, five presumably sold for cider vinegar though this was not stated, and one sample sold for grape vinegar. Of the twenty samples of vinegar thirteen compare favorably with cider vinegar so far as the amount of acetic acid is concerned, while five samples were decidedly too weak in acidity. The amount of total solids and ash indicates only one sample of pure cider vinegar. When we consider that the addition of water reduces the proportion of total solids as

well as of acetic acid, two samples indicate diluted cider vinegar. The remaining seventeen samples indicate spirit vinegar with the addition of organic coloring matter to give the nut brown color. The so-called grape vinegar is the spirit vinegar without the artificial coloring.

Our investigations show, therefore, that ninety-five per cent. of the samples of vinegar examined by us are not pure cider vinegar. The adulterants found present by us are not injurious to health, but their presence is for the purpose of deception and therefore fraudulent. Such a practice should be condemned by law.

In the United States the best known and most esteemed vinegar is that obtained in the acetic fermentation of apple cider, but by far the largest quantity is made from alcohol and spirituous liquors.

In view of the large number of analysis made in various parts of the United States and the laws enacted by many States, the following requirements seem to us not to be at all unjust:

(1) That all vinegars shall contain not less than four per cent. by weight of absolute acetic acid, and must contain no lead, copper, mineral acids or artificial coloring matter.

(2) That all vinegars must be branded with the name of the fruit or substance from which it is made, together with the name and address of the manufacturer.

(3) Cider vinegar shall not contain less than 1¾ per cent. by weight of cider vinegar solids.

CHAPTER 122, PUBLIC LAWS 1895.

AN ACT TO PREVENT THE ADULTERATION, MISBRANDING AND SALE OF FOODS.

The General Assembly of North Carolina do enact:

SECTION 1. That the introduction into the state of any article of food which is adulterated or unbranded, within the meaning of this act, is hereby prohibited; and any person who shall knowingly violate any provisions of this act shall be guilty of a misdemeanor, and for such offence shall be fined not exceeding two hundred dollars for the first offence, and for each subsequent offence not exceeding three hundred dollars, or be imprisoned not exceeding one year, or both, in the discretion of the court.

SEC. 2. The term "food," as used herein, shall include all articles used for food or drink by man, whether simple, mixed or compound. The term "misbranded," as herein used, shall include all articles of food, or articles which enter into the composition of food, the package or label of which shall bear any statement purporting to name ingredients or substances as being contained or not being contained in such article, which statement shall be false in any particular.

SEC. 3. That for the purpose of this act an article shall be deemed to be adulterated in case of food or drink, first: If any substance, or substances, has or have been mixed and packed with it so as to reduce, or lower, or injuriously affect, its quality or strength, so that such product, when offered for sale, shall be calculated and shall tend to deceive the purchaser; second, if any infer or substance or substances, has or have been substituted, wholly or in part, for the article, so that the product, when sold, shall tend to deceive the purchaser; third, if any valuable constituent of the article has been, wholly or in part, abstracted, so that the product, when sold, shall tend to deceive the purchaser; fourth, if it be an imitation of, or sold under, the specific name, brand or trade-mark of another article; fifth, if it be mixed, colored, powdered or stained in a manner, whereby damage is concealed, so that such product, when sold, shall tend to deceive the purchaser; sixth, if it contain any added poisonous ingredient, or any ingredient which may render such article injurious to the health of the person consuming it; seventh, if it consists of the whole, or any part, of a discarded, filthy, decomposed or putrid animal or vegetable substance, or any portion of an animal unfit for food, whether manufactured or not, or if it is the product of a diseased animal which has died otherwise than by slaughter: *Provided*, that an article of food which does not contain any added poisonous ingredient shall not be deemed adulterated or misbranded, in the following cases: First, in the case of mixtures or compounds, which may be now or from time to time hereafter, known as articles of food under their own distinctive names, and not included in definition fourth of this section; second, in the case of articles labeled, branded or tagged so as to plainly indicate that they are mixtures, compounds, combinations or blends; third, when any matter or ingredient has been added to the food because the same is required for the production or preparation thereof as an article of commerce in a state fitter for carriage or consumption and not fraudulently increase the bulk, weight or measure of the food or conceal the inferior quality thereof; *Provided* that the same shall be labled, branded or tagged so as to show them to be compounds: *And, provided further*, that nothing in this act shall be construed as requiring or compelling manufacturers of articles of food to disclose their trade formulas; fourth, when the food is unavoidably mixed with some extraneous matter in the process of collection or preparation.

SEC. 4. That this act shall not be construed to interfere with commerce, or any inter-state commerce laws, of the United States.

SEC. 5. That any article of food that is adulterated or misbranded, within the meaning of this act, or is transported or being transported into the State for sale, and is still in the original or unbroken packages, shall be liable to be proceeded against in any court of this state, within the district where the same is found, and seized for confiscation by a process of libel for condemnation. And if such article is condemned as being adulterated or misbranded, the same shall be disposed of as the said court may direct, and the proceeds thereof, if sold, less the legal costs and

charges, shall be paid into the treasury of the state. The proceedings in such libel cases shall conform, as near as may be, to proceedings in admiralty, except that either party may demand trial by jury on any issue of fact joined in such case, and all such proceedings shall be at the suit of and in the name of the state of North Carolina.

SEC. 6. That this act shall be in force from and after its ratification.

Ratified the 2nd day of March, A. D. 1895.